PORTLAND-MILWAUKIE LIGHT RAIL PROJECT

Noise and vibration
Final Environmental Impact Statement

Dave Unsworth, pinch hitting for Jamie Snook

Citizens Advisory Committee
May 20, 2010
Topics we will cover

• FTA assessment of noise and vibration
• Impacts and general mitigation strategies for the Portland-Milwaukie Light Rail Project

This information is draft and subject to change, pending publication of the Final EIS.
**Light rail at 50 mph**

<table>
<thead>
<tr>
<th>Noise Source or Activity</th>
<th>Sound Level (dBA)</th>
<th>Subjective Impression</th>
<th>Relative Loudness (human judgment of different sound levels)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jet aircraft takeoff from carrier (50 feet)</td>
<td>140</td>
<td>Threshold of pain</td>
<td>64 times as loud</td>
</tr>
<tr>
<td>50 horse power siren (100 feet)</td>
<td>130</td>
<td></td>
<td>32 times as loud</td>
</tr>
<tr>
<td>Loud rock concert near stage, Jet takeoff (200 feet)</td>
<td>120</td>
<td>Uncomfortably loud</td>
<td>16 times as loud</td>
</tr>
<tr>
<td>Float plane takeoff (100 feet)</td>
<td>110</td>
<td></td>
<td>8 times as loud</td>
</tr>
<tr>
<td>Jet takeoff (2,000 feet)</td>
<td>100</td>
<td>Very loud</td>
<td>4 times as loud</td>
</tr>
<tr>
<td>Heavy truck or motorcycle (25 feet)</td>
<td>90</td>
<td></td>
<td>2 times as loud</td>
</tr>
<tr>
<td>Garbage disposal (2 feet)</td>
<td>80</td>
<td>Moderately loud</td>
<td>Reference loudness</td>
</tr>
<tr>
<td><strong>Typical at-grade light rail vehicle</strong></td>
<td>70</td>
<td></td>
<td>⅓ as loud</td>
</tr>
<tr>
<td>Moderately busy department store</td>
<td>60</td>
<td></td>
<td>1/4 as loud</td>
</tr>
<tr>
<td>Typical television show (10 feet)</td>
<td>50</td>
<td></td>
<td>1/8 as loud</td>
</tr>
<tr>
<td>Typical quiet office environment</td>
<td>40</td>
<td>Quiet</td>
<td>1/16 as loud</td>
</tr>
<tr>
<td>Bedroom or quiet living room</td>
<td>30</td>
<td>Very quiet</td>
<td>1/32 as loud</td>
</tr>
<tr>
<td>Quiet library, soft whisper (15 feet)</td>
<td>20</td>
<td>Just audible</td>
<td>1/64 as loud</td>
</tr>
<tr>
<td>High quality recording studio</td>
<td>10</td>
<td></td>
<td>1/128 as loud</td>
</tr>
<tr>
<td>Acoustic Test Chamber</td>
<td>0</td>
<td>Threshold of hearing</td>
<td></td>
</tr>
</tbody>
</table>

Sources: Beranek (1988) and MM&A measured data from multiple projects

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Quiet zone

• Implement safety measures to reduce risk associated with no horn
• Applies to light rail and freight rail vehicles
• Horns will still sound under dangerous conditions
• Bells with gates

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What is a noise impact?

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## Noise and vibration impacts without/with mitigation

<table>
<thead>
<tr>
<th></th>
<th>Light Rail Noise Impacts</th>
<th>Traffic Noise Impacts</th>
<th>Vibration Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Moderate</td>
<td>Severe</td>
<td></td>
</tr>
<tr>
<td>LPA without mitigation</td>
<td>29</td>
<td>3</td>
<td>19</td>
</tr>
<tr>
<td>LPA with mitigation</td>
<td>9 (Exterior)</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

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Outreach

• All impacted parties have been met with or offered meeting prior to publication of the Final EIS

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Assessing noise impacts

1. Assess existing noise levels
2. Determine project-generated noise
3. Determine sensitivity of surrounding uses

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Noise mitigation strategies

• Sound barriers
• Track lubrication at curves
• Building sound insulation
• Adjustable crossing bells
• Directional bells and bell shrouds

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Vibration

• Caused by wheel rail interface
• Light rail vibration is always much lower than a freight train
• Testing performed to determine how vibration travels through local soils

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Assessing vibration impacts

1. Weight dropped to determine how vibration waves move through soils
2. Compare to MAX based train speed and distance to buildings
3. Compare to FTA thresholds

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Vibration mitigation strategies

• Ballast mats
• Resilient fasteners
• Tire derived aggregate
• Ballast track instead of paved track
• Special trackwork at crossovers and turnouts
• Rail grinding/wheel truing

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Legend
- Vibration Impacts with Mitigation
- Park and Ride
- Light Rail